NEUROIMAGING AND THE COURTS: PART II

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Reviewing the involvement of neuroimaging in court decisions provides insight into the types of legal issues that arise with the evolution of any new medical technology. To what extent does the increasing availability of improved medical technology modify judicial interpretations of professional standards? When does information generated by such technology reach the level of credibility and reliability necessary to support a legal claim? How does a court decide between two conflicting expert interpretations of data produced by modern diagnostic equipment? In general terms, what effect do medical innovations have on judicial analysis and decisions?

Part I of this series[1] reviewed certain court decisions where cranial imaging played a key role. This article addresses a series of cases in which spinal CT and MRI scans were critical to resolving legal disputes.

COMPUTER SEARCH

Initially, the WESTLAW* database was searched for all state court opinions that mentioned spinal imaging. Given the time required for a typical legal case to be resolved and that few spinal scans were performed before 1980, it is not surprising that the first state court decision in the database that refers to spinal CT or MRI was reported in 1983. In the ten years between 1 January 1983 and 31 December 1992, a total of 178 reported opinions made reference to at least one such form of neuroimaging.

WESTLAW STATE "SPINE SCAN CASES": 1983-1992

YEAR	CASES	YEAR	CASES
1983	4	1988	21
1984	3	1989	24
1985	11	1990	26
1986	11	1991	29
1987	15	1992	34
	TOTAL CASES:	178	

The table depicts an impressive trend. The ten-fold increase in cases that mention spinal scans parallels medicine's burgeoning use of neuroimaging. Furthermore, with 29 cases reported in WESTLAW over the first six months of 1993, the trend has continued.

Most of the reported cases concerned general negligence. Professional liability decisions were not common. Other lawsuits, including workmen's compensation disputes, most often arose out of personal injury from motor vehicle accidents, slips and falls, falling objects, or lifting heavy material. Virtually every alleged injury involved the claimant's cervical or lumbosacral spine. Unusual cases included a child abuse charge, a contractual dispute, a constitutional tort, and a divorce petition.[2,3,4,5] Several concerned issues of legal procedure only.[6,7,8]

PROFESSIONAL LIABILITY

In Part I, it was noted how modern neuroimaging technology had revealed novel conditions or altered perceptions of the frequency of known diseases. A 1987 decision from the Court of Appeals of Iowa illustrates this point.[9]

A patient was evaluated by his personal physician for low back pain in August 1980. With minimal response to rest and pain medications, the man was referred to an orthopedic surgeon. Two weeks after the initial evaluation, he was hospitalized and lumbar myelography demonstrated a herniated disc. Five weeks after he underwent a laminectomy and discectomy, the patient was noted to suffer neurological deficits of the lower extremities.

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In December 1980, three months after surgery, a neurologist diagnosed cauda equina syndrome. He ordered a lumbosacral CT scan, and that study revealed severe spinal stenosis.

In medical malpractice litigation against the referring physician, the orthopedic surgeon and the hospital, the surgeon was specifically charged with failing to diagnose spinal stenosis.

At trial, the plaintiff's expert testified that the man's neurological deficits were due to excessive surgical manipulation of nerve roots rather than their swelling secondary to spinal stenosis. The surgeon's expert testified that the plaintiff's deficits could have resulted from "normal pressure" that occurs during the type of surgery performed. He also stated that CT scanning was not sufficiently available in 1980 to permit the orthopedic surgeon to detect the man's spinal stenosis. According to the court, the expert concluded that "the medical appreciation of spinal stenosis had developed in tandem with the CT scan since 1980."

The trial court ruled for the defendant. It determined that the evidence did not support an inference that the swelling was caused intraoperatively. Moreover, the court decided that failure to diagnose spinal stenosis in this case, with or without CT scanning, did not constitute medical malpractice. The appellate court affirmed the trial court decision.

In this case, neurological damage resulted from alleged professional negligence. Some clinicians might be justifiably concerned that the judicial opinion did not take notice of the patient's functional status prior to the alleged malpractice, i.e., the surgeon's preoperative neurological examination. Additionally, although modern neuroimaging may have heightened awareness of spinal stenosis, plain films and myelography have assisted clinicians in confirming this diagnosis for decades.

Two strikingly similar cases involved delays in ordering CT scans in 1984 in the face of acute cauda equina syndrome from therapeutic misadventures.[10,11] In each case, the state supreme court reversed a decision because of a lower court's use of an improper "best judgement" or "honest error" jury instruction.

A 32 year old woman underwent spinal manipulation by a chiropractor for back spasms. After several hours, she began to experience bilateral leg numbness and weakness. A nurse recorded that the patient, shortly after arrival at a local emergency room, was unable to stand or support any weight on her feet.

An examining physician recorded that, although the patient was experiencing decreased sensation in her left leg, right leg hypesthesia was "not constant." He noted normal deep tendon reflexes, and he also performed strength testing. The physician later recalled that the patient was able to push against his hands but that effort seemed to cause her pain. This recollection of motor strength conflicted with the patient's contention that she had not been able to move her legs against resistance.

The nurse who first evaluated the patient in the emergency room subsequently recorded a further decrease in lower extremity sensation. The physician later admitted that this was reported to him before he ordered the patient discharged. Ultimately, the patient was rendered paraplegic from a large, centrally herniated disc that caused an acute cauda equina syndrome.

Malpractice suits were brought against the chiropractor, the emergency physician and the hospital. A jury verdict in favor of the physician resulted, and an appeal was taken to the Alabama Supreme Court. The appeal primarily targeted the following jury instruction:

> *There is no requirement under our law that the physician be infallible in his diagnosis or treatment of his patient. And where the proper course of treatment in a particular situation is subject to reasonable*

> *doubt, a physician is not liable for an honest mistake or an honest error in judgement, so long as he meets the required standard of care.*

Noting the trend away from such predeliberation charges in other jurisdictions, the court held "that jury instructions concerning the standard of care expected of a physician must not include language that would absolve a defendant from liability for having made an 'honest mistake', a 'bona fide error', or a 'good-faith error.' Negligence that results in injury should support a finding of liability by a jury regardless of whether the act or omission giving rise to the injury was caused by an 'honest error in judgement.' "

To support this holding, the court performed additional fact-finding. It noted that the record demonstrated that the physician suspected a spinal cord injury from the time of his initial examination. The court observed that the physician testified that it would be substandard for a physician who suspected a spinal cord injury not to immobilize the patient. In this case, the patient was never immobilized. The court commented further that "even though the record indicates that [the physician] suspected spinal cord involvement in this case, he failed to order diagnostic tests, such as a CAT scan...." The opinion is silent whether the court had considered the availability of spinal imaging in the particular Jefferson County, Alabama, community hospital in 1984, prior to rendering its 1990 decision. Although delay in scanning was mentioned, the court's final decision did not seem to rest upon such a basis.

In the second case, a 27 year old man underwent lumbar discectomy in October, 1984. Shortly after surgery, he complained of pain and numbness in the lower extremities. The surgeon's and nurses' notes indicate that the patient could not move his feet or detect pinprick. The surgeon further recorded that he believed the patient's paralysis was due to a "hysterical response" to surgery. Two days later, a neurologist evaluated the patient. An acute cauda equina syndrome was diagnosed, and an emergency CT scan was recommended. The scan demonstrated a spinal epidural hematoma. The patient underwent reoperation and was ultimately left paraplegic.

A subsequent malpractice suit alleged that the surgeon's postoperative care, including a delay in obtaining CT scanning, was substandard and resulted in harm to the patient. As in the prior case, the jury at trial was given an "error in judgement" instruction, over the plaintiff's objection. The jury decided for the surgeon, and plaintiff's motion for a new trial was denied.

The denial of a new trial was reversed at mid-level appeal, and the surgeon consequently appealed to the Supreme Court of Idaho. Focusing on the contested jury charge, and against the factual backdrop of clearly deficient postoperative management, the Court decided that "such instructions not only confuse, but they are also incorrect because they suggest that substandard conduct is permissible if it is garbed as an exercise in judgement." A new trial was ordered.

In the previous two cases, lawsuits concerning faulty professional judgement were partly manifested by delays in ordering neuroimaging studies. Although these cases were factually uncomplicated, both significantly modified their states' medical negligence law.

OTHER NEGLIGENCE

In many negligence claims that follow vehicular accidents and occupational injuries, the presence or the extent of spinal damage is at issue. In the majority of cases from the WESTLAW search, liability was conceded. The information from scans was used exclusively to assess the presence or extent of injury. Unfortunately, courts have encountered numerous obstacles in that regard. When modern neuroimaging was introduced, technical problems were particularly troublesome, and questions concerning the reliability of scans as evidence were raised.

In 1976, a woman injured her back while lifting a bundle at work and subsequently developed persistent back and right leg pain. A discectomy at L4/5 was performed. In 1978, with continued back pain, she was evaluated by an orthopedic spine specialist. He ordered a lumbosacral CT scan. More surgery was undertaken at the same level and at L5/S1. Her back pain persisted through another evaluation by the spine specialist that occurred two weeks before the patient was involved in a motor vehicle accident late in 1979.

Seven weeks after the accident, the woman was reevaluated by the specialist. Ultimately, a third surgery, following a second CT scan, was performed at L4/5. Disc herniation at L3/4 was discovered intraoperatively. The patient subsequently filed a lawsuit against the driver of the other vehicle, alleging that a "new" disc injury at L3/4 had resulted from the accident.[12]

At trial, the spine specialist testified that the first CT scan performed in 1978, prior to the patient's second surgery, revealed neither an abnormality at L3/4 nor the L5/S1 disc herniation that was discovered intraoperatively. He admitted he had not examined the L3/L4 level during that operation. In addition, the CT done before the third surgery had not demonstrated an L3/L4 disc herniation. The specialist concluded his testimony stating summarily that CT scans "can be unreliable in these cases."

How should the unreliability of these scans be apportioned between the technology and the technologists? A key practical issue regarding the scans in this case remains open to question: whether the herniated discs initially discovered during surgery **could** have been visualized on CT, i.e., whether all three intervertebral spaces were included in either scan, or both.

In September 1982, a man suffered back injury at work that was diagnosed as a pulled muscle by his employer's physician. An orthopedic surgeon concurred with that diagnosis following subsequent examination. By November 1982, the patient's back was without spasms, and a full range of motion had returned. He was allowed to resume work, but was laid off soon thereafter. Within days, the man consulted a specialist in physical medicine and rehabilitation, who ordered a lumbosacral CT scan. The physiatrist interpreted the scan as demonstrating a disc herniation and continued treatment until April 1983. This CT was later reviewed by a radiologist, a neurosurgeon, an orthopedic surgeon and a neurologist. Each of these physicians interpreted the study as normal.

The man filed suit against his employer for total and permanent disability. The physiatrist testified that the plaintiff suffered degenerative arthritis, coupled with a herniated disc, that prevented him from returning to work as a laborer. The trial court, however, found that the preponderance of expert testimony supported a conclusion that the man suffered a mild back injury, without objective signs of total or permanent disability. The court decided in favor of the employer.

An appellate court, in affirming the decision, declared that "[i]t is the duty of the trial judge to evaluate the testimony of all the witnesses, both lay and medical. After making such an evaluation, he may accept or reject the opinion expressed by any medical expert, depending on how impressed he is with the qualifications, credibility, and testimony of that expert."[13]

In this case, the trial judge discounted the physiatrist's radiologic interpretation after weighing it against the testimony of all the other experts. In many other cases, experts disagree on subtler questions, such as whether a neuroimaging finding represents an abnormality, a normal variant or an artifact, or whether an abnormality is acute, chronic or age indeterminate. Nowhere is this more evident than in cases involving disc bulges.

In May 1982, a 30 year old woman consulted a neurosurgeon for neck and upper back pain that had persisted for six weeks after a rear end motor vehicle collision. She employed a hard cervical collar but returned in June 1982 with the pain undiminished. While driving home, a truck backed into the patient's automobile. When the patient returned to the neurosurgeon in July, her neck pain was unchanged, but she had begun experiencing low back pain. By her next visit in September, she had been involved in a third motor vehicle accident. Despite that fact, her neck pain was nearly resolved. She continued to complain of severe low back pain.

The neurosurgeon managed her low back pain conservatively and, by mid-1983, the patient had returned to work as a terminal controller for a railroad. When evaluated in April 1984, she complained of minimal neck and low back discomfort. Not until the neurosurgeon evaluated the patient in March 1986 did she inform him of a fourth motor vehicle accident that had occurred in February 1984. Meanwhile, in 1984, the woman had filed a lawsuit stemming from the June 1982 motor vehicle accident.

In October 1986, the plaintiff underwent CT and MRI scans of the lumbosacral spine. A neuroradiologist interpreted these studies as indicating a minor bulging of the lumbosacral disc, more pronounced posteriorly, with MRI evidence of disc degeneration without herniation, and minor circumferential bulging of the L3/4 and L4/5 discs. The neurosurgeon, during a follow-up evaluation in November, recorded that there were midline bulges at L4/5 and L5/S1. In April 1987, he concluded that the patient had a chronic lumbar disc injury with L4/5 bulge and marked L5/S1 disc damage and bulge.

At trial, the neurosurgeon testified that the patient's injury had been initiated by the June 1982 motor vehicle accident. He testified further that his two examinations of the plaintiff prior to that accident indicated problems limited solely to the cervical spine. On cross examination, defense counsel focused upon a 1984 report where the neurosurgeon had concluded that there were no mechanical or neurological signs of a ruptured disc.

The physician subsequently disagreed with his earlier statement, pointing to the imaging studies in 1986 that showed structural damage to the spine. He testified that his report in 1984 was in error both when it stated that there was no disc problem and that only six months would be needed for recovery.

An orthopedic spine specialist, who had examined the plaintiff at the defendant's request, testified that the neurological and mechanical function of her lumbosacral spine was entirely normal. He also reviewed the CT and MRI scans and concluded there was "normal bulging" at all five disc levels seen on the studies.

A second neurosurgeon testified that the history he obtained from the plaintiff indicated that she had experienced low back pain before the June 1982 motor vehicle accident. The findings from his physical examination were identical to that obtained by the orthopedist. Likewise, upon review of the scans, he detected bulges at L4/5 and L5/S1 but concluded they were "normal in a 35 year old person."

The trial court entered judgement on a jury verdict denying recovery, and the plaintiff appealed.[14] She argued, among other points, that the jury improperly disregarded the testimony of her medical experts. The appellate court, noting that the first neurosurgeon was the only expert to testify that the June 1982 accident had caused a structural low back problem, concluded that the jury had not manifestly erred. The court affirmed the jury's conclusion that the plaintiff did not prove she was injured in that accident.

Finally, a case decided by the District of Columbia Court of Appeals in 1989 involved multiple scans, disc bulges, and surgery in a workmen's compensation dispute.[15]

A man fell while working in a restaurant kitchen in February 1984 and injured his lower back. Five days later, he was evaluated by a physician, who prescribed conservative measures. The patient returned to work in August 1984, but began complaining of right-sided low back pain several months later.

After further conservative therapy, the initial treating physician referred the patient to an orthopedic surgeon. The surgeon's assessment included lumbosacral spine x-rays with a bone scan, and he concluded that the patient had no evidence of spinal degeneration. A physical therapy program was begun, as were temporary total disability benefits.

A second orthopedic surgeon examined the patient in May 1985 and ordered a CT scan from L2 to S1. The scan revealed no abnormalities. The patient was then referred to an orthopedic spine specialist, who found no objective findings to support continued clinical complaints. A second scan from a university hospital was "completely normal", except for minimal bulging at L4/5. Consultation with a rheumatologist provided no additional insight into the patient's low back pain.

A referral to a pain center was made in August 1985, about the time the patient's disability benefits were terminated. After several visits, a pain center physician determined that the patient would not benefit from treatment because no impairment prevented a return to work and he was "inadequately motivated". An attorney then gave the man the telephone number of a neurosurgeon, who, as part of his evaluation, ordered an MRI scan. The report of the scan declared there were "[b]ulging discs posteriorly ... with some encroachment on the neural foramina at L4/5 and L5/S1." Surgery was recommended.

Because his disability benefits had been terminated months earlier, the man administratively requested that the bills from the neurosurgeon and the MRI be paid, the proposed surgery be authorized, and his disability be reinstated. These requests were denied. In August 1987, while an administrative appeal to the director of the appropriate municipal agency was pending, the patient underwent decompressive laminectomy. He later sent a copy of the discharge summary for that hospitalization to the director, who refused to consider it within the record for appeal. The hearing examiner's denial was affirmed.

A lawsuit was filed. It alleged, among other things, that the denial of medical expenses and disability benefits after August 1985 was not supported by the evidence and that the hospital discharge summary, from the laminectomy, should have been included within the record for appeal.

The District of Columbia Court of Appeals noted that all other practitioners involved with the case had considered the CT scans as essentially normal and that "[t]he MRI procedure ordered by [the neurosurgeon] was the only test that detected a possible physical cause, but even the MRI report indicated at most a minimal encroachment of a disc on a nerve." The court decided that the denial of benefits was based upon substantial evidence. The court also determined there **was** error in not considering the discharge summary, because that report was evidence material to the plaintiff's alleged injury. It ultimately, however, deemed the error harmless.

In supporting the determination of harmless error, the court obtained the complete hospital record and recited from the Operative Report:

> *The discs at L4/5 and L3/4 were then carefully inspected, especially on the right side, and noted that there was no evidence of any herniation at that point. After de-roofing the canal and evaluating that the discs were not herniating, the incision was then closed.*

The court then wryly observed, "Thus we can say with substantial certitude that the hearing examiner would have made the same ultimate finding [i.e., denying the benefits requests], and that the Director would have been obliged to affirm it, even with the error removed."

CONCLUSION

The number of courts that will be asked to consider evidence generated by modern neuroimaging should continue to increase. As these two case series have clearly demonstrated, when courts encounter CT and MRI scans of the head or spine, they also encounter some problems with neuroimaging familiar to clinicians.

Providers whose practices employ this technology are repeatedly reminded of two well-founded maxims. First, the clinical value of a CT or MRI scan is dictated by the quality of the imaging technique in its production combined with the professional expertise used in its interpretation. If a scan lacks either, improper conclusions are drawn and poor clinical decisions are made. Second, information derived from any scan must be clinically correlated. As some surgeons are fond of declaring, "Operate on the patient, not on the scan."

Similarly, courts have been challenged by the uneven technical quality of neuroimaging studies submitted as evidence. They are also asked to weigh various expert interpretations, at times conflicting, to arrive at a decision. Sound judicial opinions result when all pertinent evidence is considered. Uncritical reliance upon this extraordinary, yet fallible, technology is as imprudent judicially as it is clinically.

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